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REPORT FROM THE TASK GROUP

ON

MINERALS & MATERIALS TECHNOLOGY

August, 1989

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ACKNOWLEDGEMENTS

In February 1988, a Task Group on Minerals and Materials Technology was established to identify key technological opportunities and constraints to mineral development in the Province and to recommend appropriate measures to stimulate and accelerate development of this industry. Funding, for Task Group expenses, was provided under the Canada/New Brunswick Subsidiary Agreement on Industrial Innovation and Technology Development. Members of the Group gave freely of their time, expertise and guidance in the compilation of this report. Input provided by other government departments, industry representatives, the Research and Productivity Council, and the University of New Brunswick also contributed to the compilation of this study.

We wish to acknowledge and thank the numerous contributors who assisted us in the study and a special thanks to William G. Paterson and the Department of Commerce and Technology for providing the opportunity to provide this input. Also a special thanks to Stephen Battah for arranging the meetings, recording the minutes and in general contributing to the smooth functioning of the Group and compilation of the final report.

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1.0 EXECUTIVE SUMMARY

In early 1988 the Task Group on Minerals and Processing Technology was formed, consisting of 12 members representing most facets of the mineral industry. The overall objective of this Group was to determine how employment opportunities in the mineral sector could be enhanced through accelerated development. The approach taken was to identify technological strengths, opportunities and constraints and to recommend action considered appropriate. Although the primary mandate was to assess technological opportunities, members of the Group felt that regulatory and other impediments were also significant constraints to development. Therefore a separate section was added to include this aspect.

The mineral industry contributed in excess of 800 million dollars to the gross domestic product of New Brunswick in 1988 and of the primary industries is second only to forestry in importance. Direct employment is currently at 5000 employees which are distributed throughout most of the province although there are larger concentrations in Northeastern New Brunswick and the Sussex area. Of greater significance, is this sector's potential for expansion and growth. Unlike forestry, which has limited expansion potential because of a fully utilized resource base, the mineral industry has large undeveloped reserves capable of sustaining expansion into the foreseeable future. With sound management, long range planning and an appropriate level of investment by both industry and government, this sector can play an ever increasing role in this province's prosperity.

Following is a summary of recommendations which the Task Group believes will accelerate development if appropriately addressed. Although all the recommendations are considered to be important we have attempted to establish priorities within specific categories (eg. Exploration) without prioritizing the categories. The letters beside the recommendations indicate the relative rating with "A" being the highest priority, "B" indicating moderate and "C" lesser priority.

EXPLORATION

A 1. Compilation of geoscientificdata is essential to sustain exploration. Therefore, it is recommended that the current compilation program be accelerated and changed to a computer based format utilizing an available system. A 5 to 7 year target for completing this work is considered appropriate.

C 2. Remote sensing data is useful in exploration, environmental planning and urban development. UNB, which already has expertise in this field, should be developed as a "Centre For Remote Sensing" with the capability of providing research and technical assistance to those engaged in geoscientific work.

B 3. High quality geological, geophysical and geochemical maps are an essential source of information, however in many areas this data is outdated or incomplete. It is recommended that geological mapping of the province be completed within 10 years, at a scale of 1:50,000 for the Pennsylvanian areas and 1:20,000 for the remainder of the province. It is also recommended that geochemical and geophysical coverage be increased to a level more compatible with geological coverage and that staff, with expertise in these disciplines, direct the work. All pertinent geoscientific data should be updated at regular intervals.

DEVELOPMENT, MINING AND PROCESSING

A 4. The province should stimulate interest, not only in the undeveloped deposits of base metals and industrial minerals, but also in the development potential of specialty metals (eg. titanium, magnesium, etc) and possibly rare earth. Staff from within government, having expertise in resource definition, development, processing and marketing, should examine mineral occurrences, prepare an inventory, and promote those with economic potential to interested developers.

C 5(a). Metal mining, although the largest contributor to mineral production, has developed less than a third of the more than 300 million tonne known reserve in the Province. The lower grade of the undeveloped reserve, plus the difficult metallurgy have, to date, made development of these uneconomical. Research, by numerous agencies, from many countries, has been unable to adequately resolve the metallurgical problems therefore it is difficult to recommend an all out research assault at provincial expense. However the province should maintain a nucleus of metallurgical expertise to evaluate new technologies both in processing and treatment of resulting tailings.

A 5(b). Waste management of tailings and waste rock produced by the base metal industry is of great concern with respect to the future and development of the industry. It is recommended that support be given to such committees as the Mend (Mine Effluent and Natural Drainage Committee) and that funding for R&D designed to ameliorate the effects of acid drainage be suitably allocated.

B 6. The potash industry, which is the second largest contributor to mineral production, is generally self sufficient with respect to routine research. However the New Brunswick ore bodies, because of complicated deformation, present unique mining challenges. Resolving these could result in better utilization of the resource and more efficient extraction thereby improving the competitive position of the industry in world markets. Consequently it is recommended that government support research directed in attaining this goal. Because of the importance of this sector it would be appropriate for government to retain staff person having a strong background in potash mining and capable of meaningful participation in this type of research.

A 7. New Brunswick has significant reserves of industrial minerals such as limestone, dolomite, silica, granite, etc. but the producers are relatively small lacking research and market development capabilities. Assistance in these areas and in evaluating new technology is required in order to stimulate production expansion.

A 8. Only 13 percent of the total peat areas of the Province are under development, representing less than 50 percent of the bogs considered to have commercial potential. This provides real opportunities for expansion if additional markets can be developed. Since approximately 90 percent of the currently harvested peat moss is sold in the unprocessed state, increasing markets through new product development merits investigation. It is recommended that the Peat Research and Development Centre be given the mandate to develop new products and to develop new techniques for harvesting and processing of the peat. The Centre should be directed by a board whose majority of members are from industry.

MANUFACTURING AND VALUE ADDED

A 9. Zinc concentrate is the largest component of unrefined metal leaving the Province. Although this presents an opportunity for adding value to the product, there are significant constraints such as refinery over-capacity, high capital cost and high power rates. If a complete zinc refinery is not economically feasible, alternatives such as partial treatment should be investigated thoroughly. For instance, a roaster would add value to the current export and perhaps spawn a new industry utilizing the increased acid supply. This would provide long-term employment and economic benefit to the Province.

B 10. Lead, presently produced in the Province, should provide the impetus for creating a manufacturing industry converting this metal into such items as batteries, solder, flashing, weights, pipe, lead based asphalt, etc. The potential of this secondary manufacturing should be investigated.

A 11. Current market demand is the major constraint to expanded potash production. Therefore any increase is dependent on greater penetration of the existing granulated fertilizer market and/or the development of new products. Studies into the feasibility of producing new products such as soluble and refined KCl or K_2SO_4 should be investigated.

A 12. Industrial minerals are generally sold in end use form, therefore any expansion must come from increased market penetration or diversification into new products. To assist producers with new products and associated technological development, it is recommended that government staff track these, and through regular seminars inform interested producers of the opportunities.

MARKETING

B 13. Metals and potash are traded on the world market, which cannot be easily influenced by either producers or governments. To succeed in this market producers must be globally competitive and governments must provide a reasonable regulatory and tax environment as well as competitive power rates.

B 14. Industrial minerals and peat producers, because of their relatively small size, would benefit from a government department that takes a leading role in both market development and insuring maximum usage of indigenous material in projects undertaken within the Province.

RESEARCH AND DEVELOPMENT

A 15. A central coordinating agency for research and development in the mineral industry is required. The mandate of this agency would be to develop an overall research strategy with well defined objectives directly related to mineral development and to coordinate associated activities undertaken by such groups as UNB, DNRE and RPC. Funding should be appropriated for both the agency and basic research and administered by the agency.

B 16. The government should catalogue and produce a directory of research capabilities present in the Province as an aid in the formulation of the strategy and as an aid to industry and government.

C 17. As a consequence to the above two items and once development of associated research is established, the agency should delineate high risk pure research ventures, which could be jointly funded and administered by government and industry in designated provincial facilities.

A 18. The province should support the establishment of a Chair in Economic Geology at UNB to facilitate and encourage the interaction between industry and academic institutions.

B 19. In this era of global competition, maximizing mineral development in this Province will require the co-operation of Industry, Government and Education/Research Institutions. To facilitate this co-operation it is recommended that the Task Group on Materials and Mineral Technology be maintained in some form. This Group can provide a forum for the exchange of ideas, facilitate communication between agencies, and provide valuable input to government. Such a Group could meet quarterly and submit an annual report.

EDUCATION AND TRAINING

A 20. Although the mining industry is an important contributor to the Province's economy, public awareness of its impact is limited. As a first step in alleviating this situation it is recommended that student awareness programs be initiated at the high school level. These can be expanded to include other age groups.

B 21. To insure that individuals currently engaged in the mineral industry remain abreast of new technology, it is recommended that support be provided for educational institutions sponsoring work shops, seminars, etc.

B 22. It is also recommended that vocational training be provided on an apprenticeship basis to (1) Mine Operator, (2) Mine Technician, (3) Mill Operator, (4) Mill Technician, (5) Exploration Technician.

REGULATORY AND OTHER CONSTRAINTS

During the preparatory stage of this report it became apparent that industry viewed regulatory constraints as significant impediments to mineral development. Therefore it was considered appropriate to include a section, in this report, expressing these concerns.

DNR&E ORGANIZATION

The perception of the mineral industry is that this sector has a low priority in government and the allocation of funding reinforces this view. Modest budgets, over many years, have adversely affected the ability of the Mines Branch to effectively provide the research stimulus required for expansion in this sector. Mining, although not a renewable resource, could be sustainable if adequate levels of funding are provided to stimulate exploration activity.

A 23. The appointment of a Minister of State for Mines is considered to be a positive step by the industry, providing the Minister is given the proper authority as well as an adequate level of funding to discharge his responsibilities with respect to the mineral sector. To achieve this, it is recommended that funding be provided commensurate with the mineral industries contribution to the provincial economy. Also that the organizational structure of the Department of Natural Resources and Energy be modified to reflect this sector importance

A 24. It is recommended that the structure of the Department of Natural Resources and Energy be modified to reflect the diversity of the industry. Expertise, in the sectors that are major contributors to the provincial economy or have the potential of becoming so, could stimulate research and evaluate opportunities resulting in new or accelerated development of the Province's mineral resources. Any restructuring of the Department should also assess the advantages and disadvantages of separating regulatory functions from the research, service and promotional activity.

A 25. The organization of government departments with overlapping jurisdictions should be reviewed to determine the most effective structure for discharging their respective duties.

ACTS AND REGULATIONS

This is a related problem to the foregoing. Acts and Regulations pertaining to mining, health and safety, environment, land use, etc. have proliferated in recent years. The resulting complexity and jurisdictional co-responsibility are resulting in lengthy delays negatively impacting development.

A 26. It is recommended that all Acts and Regulations pertaining to, or affecting mineral development, be reviewed with the objective of simplifying and consolidating the information. A clear understanding of the rules can be a stimulus to mineral development.

MINING ACT

A 27. The Task Group identified one particular aspect of the Mining Act that should be addressed without delay. Current regulations, which require the marking of boundaries and placing of corner post when staking claims, creates conflict with private land owners. To alleviate this problem it is recommended that the province adopt map staking.

ENVIRONMENT ACT

A 28. Environmental regulations are one of the major constraints to development and need not be if the parties address their respective responsibilities in a constructive and cooperative manner rather than assume a negative confrontational approach. To help achieve this goal it is recommended that a critical path flow sheet be formulated setting out requirements, schedules, etc. necessary for project approval. Also government should set up a committee, whose obligation it would be, to assist applicants through the approval process and following the previously established critical path.

A 29. It is also recommended that government establish an independent centre of expertise to provide technical assistance in environmental matters to both industry and government.

TAXATION

Taxation can act as a constraint or an incentive to development and it is increasingly contributing to the former. Reversing this trend will promote more investment in the province and increase job opportunities.

A 30. It is recommended that all forms of taxation be reviewed periodically and that a consistent and equitable tax policy be established which would contribute to the competitiveness of the industry.

A 31. A second recommendation is for the removal of sales taxes from all non-production equipment related to testing new mine, mill and processing equipment.

A 32. Also it is recommended that municipal taxation take into account the "project valuable" aspect of mine assets. Unlike most municipal real estate, which generally appreciates in value, mine assets generally depreciate with depletion of the ore reserve. This aspect should be taken into account when assessing mine property.

ASSISTANCE PROGRAMS

A 33. The proliferation of assistance programs has made it virtually impossible for anyone to keep abreast of them and the associated red tape discourages many potential applicants. It is recommended that programs be rationalized in terms of numbers and application procedures. Also that funds be more specifically targeted to projects having the greatest potential for creating long-term employment and opportunities. Only a small portion of the funding should be made available to high risk projects.

TRANSPORTATION

All aspects of transportation are important to the mineral industry and can constrain development. It impacts on the shipping of mineral products to the extent that it may determine the economic viability of a project. Also employee access to work sites, often remote from existing communities, affects the operating cost of an operation. Economic activity cannot approach its full potential without a good transportation infrastructure.

A 34. Provincial roads are of immediate concern since they are already negatively impacting development. It is recommended that reconstruction of Highways 8 & 11 be accelerated and that Highway 865 be improved to a standard not subject to seasonal weight restrictions. Also the Bathurst-St. Quentin Road (Route 180) should be hard surfaced to provide access to four developing properties and truck access to Maine markets.

B 35. It is also recommended that government change its policy with respect to providing access roads to developments that have long-term potential. Since most of these become public roads they should be provided by government.

2.0 INTRODUCTION

The Canada/New Brunswick Subsidiary Agreement on Industrial Innovation and Technology Development was signed on May 28, 1986. The agreement came about as the result of a recommendation from a study by A. D. Little entitled New Brunswick's Science and Technology Strategy, and by New Brunswick's commitment to technology resources as a means of stimulating industrial growth in the province.

One of the areas identified as being of strategic importance was the mineral industry of New Brunswick.

The Task Group on Minerals and Materials Technology was thus established to:

1. *"Identify key technology strengths and opportunities to develop new and improved products or processes and prioritize these opportunities, in terms of their contribution to Agreement objectives, namely:*

   - *improving the competitiveness of existing industry;*
   - *diversifying the existing industry;*
   - *establishing new production and the resulting investment and employment, and*
   - *creating employment in research and development.*

2. *Identify and prioritize measures necessary to assist the private sector in the development and application of technology."*

The following report, which summarizes the findings of the Task Group, is divided into two sections. The first addresses the objectives listed above dealing with technological constraints and opportunities.

The second section outlines Regulatory and Other Opportunities and Constraints since these are also significant obstacles to development. The Task Group considered this an appropriate addition particularly if a broader interpretation is taken of the overall objective, which is to increase employment opportunities in New Brunswick.

3.0 MINERAL INDUSTRY ECONOMIC IMPACT

Although New Brunswick has been a mineral producer for over 100 years, this sector was a relatively small contributor to the provincial economy until the early 1960's when base metal development began. Since then the industry has grown and diversified, becoming a major contributor to the gross domestic product of New Brunswick. Figure 1 shows the value of mineral production from 1978 to 1988 in current dollars while Figure 2 shows the contribution made by various mineral commodities to the annual total.

As indicated by Figure 2, metals and potash constitute 83% of the total mineral value, with fuels, peat and industrial minerals (except potash) accounting for the remaining 17 percent. Although the major producers are concentrated in northeastern New Brunswick and the Sussex area, mineral producing operations are widely dispersed throughout most of the province as are the suppliers, contractors and fabricators who provide services to the industry.

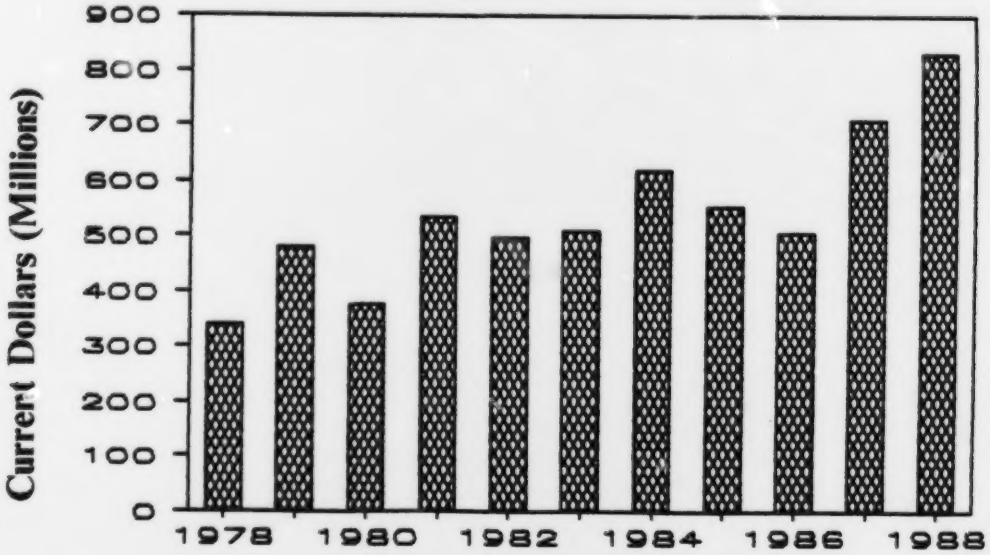
Table I, which provides 1985 statistics (the latest available) compiled for the metal and potash operations, is indicative of the economic impact mining has on the province.

TABLE I

1985 Statistical Data Compiled by the NBMA for the Metal and Potash Operations (Represents 83% of the Mineral Sector).

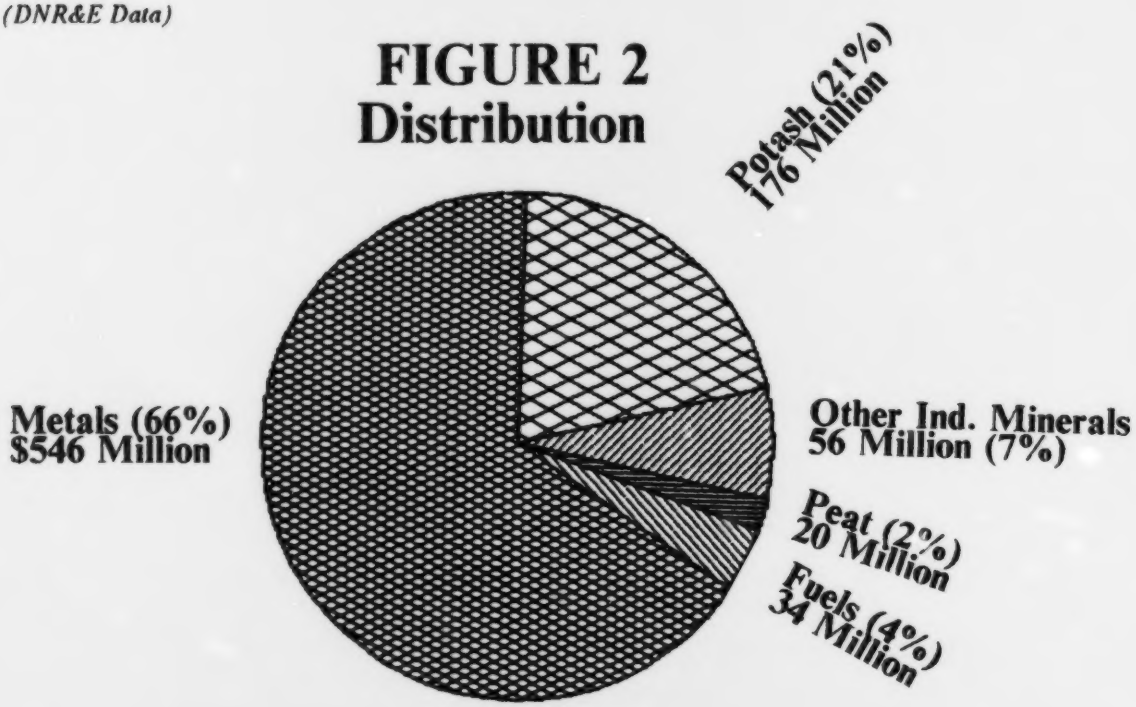
	$X1000
Payroll	103,965
Fringe Benefits (Company Contribution)	19,325
Employee Payments (FIC, CPP, UIC)	30,945
Supplies Purchased in N.B.	101,383
Supplies Purchased elsewhere in Canada	107,964
Electric Power Cost	20,591
Capital Expenditures (10 yr. ave.)	61,455
Development Expenditures	7,169
Exploration	3,762
Accident & Sickness Prevention	1,339
Ventilation and Hygienic	2,822
Environmental Testing	2,980
Provincial Taxes (10 yr. ave.)	9,378
Federal Taxes (10 yr. ave.)	6,950

FIGURE 1
Value - N.B. Mineral Production



(DNR&E Data)

FIGURE 2
Distribution



1988 Mineral Production by Components

(DNR&E Data)

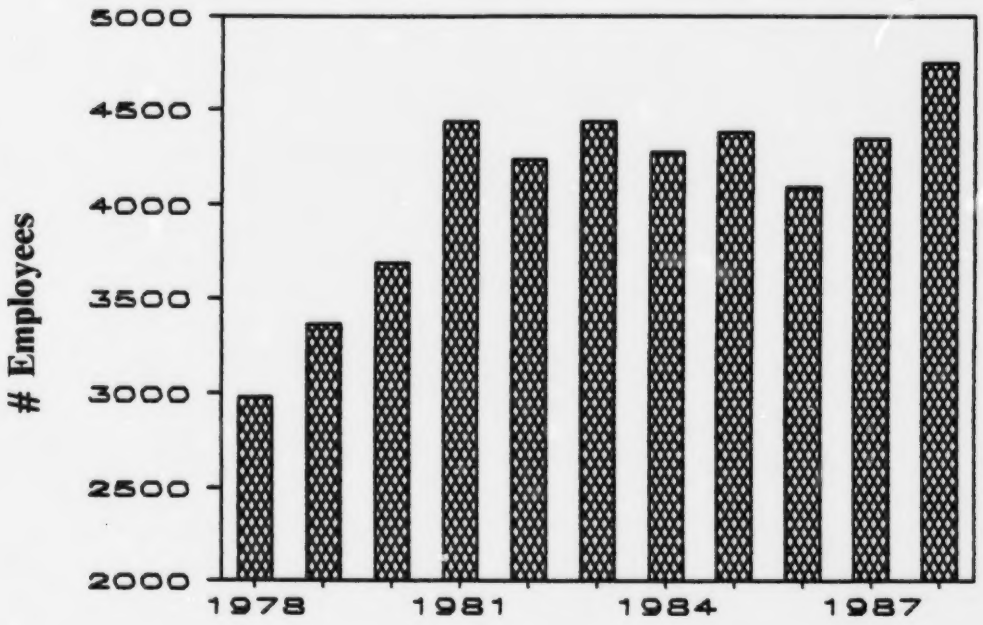
Direct employment in the mineral sector is currently approaching 5000 jobs, versus 3000 jobs in 1978 (See Figure 3). The generally upward trend in employment even with its modest fluctuations is considered to be indicative of a strong and expanding industry.

Mining has become the second largest industry in the Province, exceeded only by the forestry sector. Unlike forestry, where the potential for expansion may be limited by the supply of traditional wood species which cannot be increased beyond the current level for at least 30 years, mining has the potential to expand.

Since 1986 the value of mineral production has increased by nearly 65 percent and this upward trend is expected to continue or even accelerate due to the number of new projects currently underway. Properties now operating have ample reserves for more than 25 years of production and there is potential for increasing these significantly. There are also large tonnages of known undeveloped resources that have future production capability. These factors, coupled with a favourable geological environment, and a proficient exploration community, should insure a healthy future for the industry in this province.

However to insure that this potential is achieved will require sound management, long range planning and investment by both government and industry. Mining is a long-term growth industry, sustainable into the foreseeable future, and its economic contribution should continue to increase.

FIGURE 3
Employment - N.B. Mineral Industry



(DNR&E Data)

4.0 TECHNICAL OPPORTUNITIES, CONSTRAINTS, RECOMMENDATIONS

4.1 EXPLORATION

The post 1950 discoveries, of world class mineral deposits, have established New Brunswick as a significant producer and exporter of mineral products. The recognized potential for additional discoveries has provided impetus for more or less continuous exploration activity. This on-going activity has resulted in the establishment of a relatively stable resident core of well qualified individuals, companies and institutions with expertise in most facets of exploration technology utilized by the industry today.

As might be expected this core expands and contracts depending on the level of exploration activity, which in turn is driven by commodity markets and/or economic activity. Graphs in Figures 4 & 5, which show claims recorded and exploration expenditures, illustrate the cyclic nature of this sector. More importantly, Figure 5 shows a relatively level trend in exploration expenditures, when expressed in constant 1987 dollars. This should be of concern to New Brunswick because exploration activity should increase proportionally to production if the latter is to be sustained or expanded. The present unfavourable trend can be changed with appropriate measures some of which are outlined in the following section.

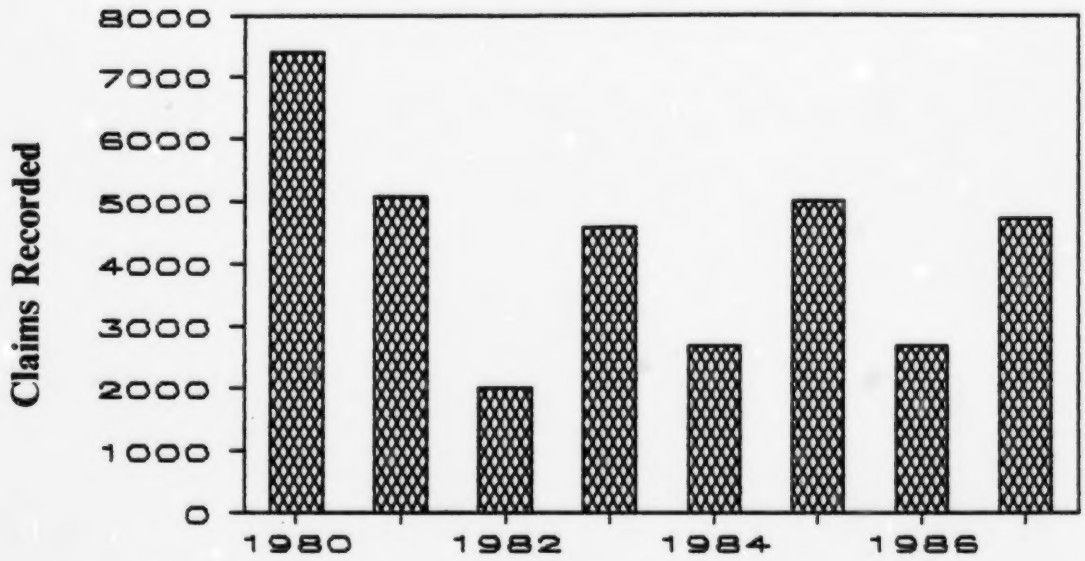
4.1.1 *Geoscientific Compilation*

Opportunities/Constraints

Normally any explorationist, commencing a new project, undertakes a compilation of all available data relevant to mineral exploration for the area under investigation. The objective is to avail oneself of the work previously completed in the area of interest. Similar exercises are undertaken on large, regional scales as a means of identifying exploration targets overlooked by those previously concentrating on smaller areas. This process is repeated by every individual or firm undertaking exploration in an area new to them. This recurring expense is wasteful and diverts resources from actual mineral exploration in the field.

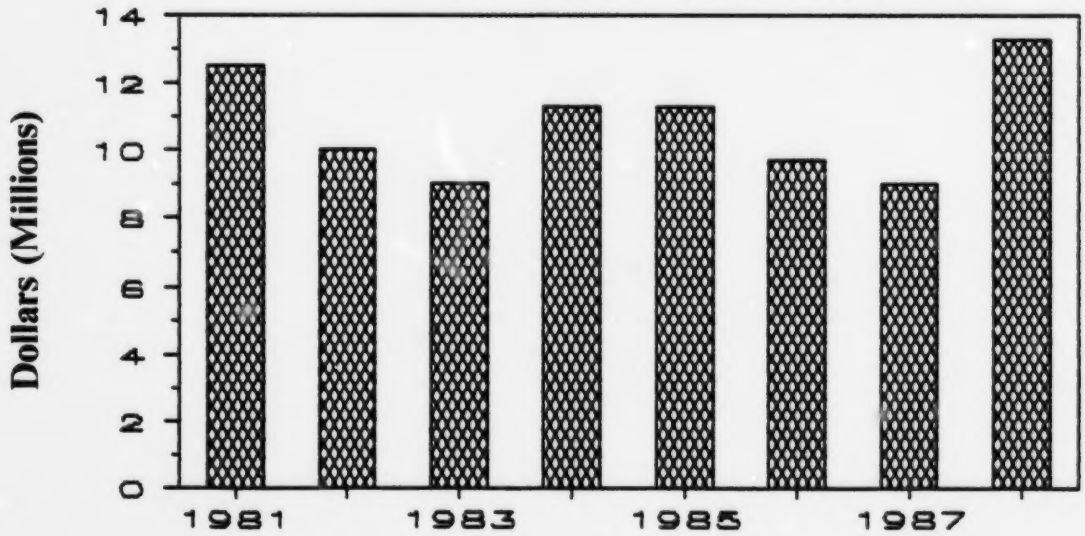
The Department of Natural Resources and Energy has begun a compilation which when completed would alleviate explorationist from this recurring task. However to date only one map sheet (21O/8) of the 90 comparable sheets necessary for provincial coverage has been finished. This means that complete coverage of the Province will not be available until the next decade at the earliest.

FIGURE 4
N.B. Claims Recorded



(DNR&E Data)

FIGURE 5
N.B. Exploration Expenditures



(Statistics Canada Data, Indexed to 1987 Dollars)

The current geoscientific compilation is based on hard copy. As a result it will require manual updating and photographic reproduction for scale alteration. These features do not provide the best format for potential users, or those responsible for updating the data, thereby restricting its future usefulness.

Recommendations

It is recommended that the geoscientific compilation program be accelerated with a target completion date of 1995 for the initial compilation. During this period it is suggested that sheets be compiled on a priority basis following consultation with potential users. The compilation format should also be changed from the current hard copy base to computer based, so that all data is in digital form.

This type of format is readily amenable to updating, reproduction, scale change, manipulation etc., allowing for use in a multitude of combinations. Upon completion of the initial data synthesis and input, the file with proper updating and maintenance, can form the basic reference for all data acquired and disbursed by the department.

A number of computer systems, already developed for this type of compilation, are readily available. It is strongly recommended that the most appropriate one be selected for use by the Province so that work on this program can begin immediately. Attempting to develop a self-styled, in-house system will result in needless delay and unnecessary expense.

4.1.2 Remote Sensing

Opportunities/Constraints

Various remote sensing programs are potentially useful to geologists, explorationists, geotechnical engineers, hydrologists and environmentalists. These include the U.S. Geological Survey's National High Altitude Photography Program (NHAP), Side-Looking Airborne Radar Program (SLAR) and the Shuttle Imagining Radar Program (SIR). Such data can provide an inexpensive regional analysis that will serve as a basis for the planning and execution of detailed site-specific studies. It has been found that a number of techniques can be used in an interactive manner with each other and with field checking and computer processing techniques to yield optimum interpretation. Short wave infrared (IR) thematic mapper (TM) spectral bands, high spatial resolution and synthetic aperture radar (SAR) when combined with Landsat/multispectral scanner system (MSS) will substantially improve these systems for use in geologic mapping and mineral exploration.

The Surveying Engineering Department of the University of New Brunswick has expertise in this field, however public user access to this expertise is not readily available, and a mechanism to provide user oriented research in earth science applications is lacking. Consequently remote sensing data, and particularly new developments in geoscientific applications are not utilized to their fullest potential by geoscientists in the Province

Recommendations

Remote sensing technology and its products need to be made more readily available to potential users in the province.

Although the Department of Natural Resources and Energy would appear to be the logical agency for delivery of this technology, the expertise resides within the University of New Brunswick. Therefore to avoid duplication of effort, it is recommended that UNB become the Centre of Remote Sensing with research and advisory capacity designed to provide appropriate data and/or assistance to parties engaged in geoscientific programs.

4.1.3 Geological, Geochemical and Geophysical Data Base

Opportunities/Constraints

High quality geological, geochemical and geophysical maps form the basis for all mineral exploration, hydrological evaluations, land use and environmental studies. Therefore, detailed geological, geochemical and geophysical investigations are necessary if the province is to provide a first quality geoscientific data base.

Various bedrock mapping projects, undertaken by the New Brunswick Department of Natural Resources and Energy since the early 1970's, have added greatly to this data base. However, the mapping produced to date should be regarded as the "first pass" coverage required to define specific locations and/or rock units warranting more detailed work.

The mineral industry in the province depends heavily upon geochemical data, both public and proprietary. In recent years the acquisition of new geochemical data by the public sector in the province has been undertaken primarily by the Geological Survey of Canada. The province's ability to provide any geochemical expertise either to fulfill its internal needs or to advise the private sector has been hampered by the lack of a provincial geochemist. That situation, although recently corrected, has left a considerable gap in the Department of Natural Resources and Energy's capabilities. The availability of local (provincial) expertise capable of advising both the provincial and federal governments and the private sector in matters dealing with the acquisition and interpretation of all types of geochemical data is a must.

As is the case for geochemical data, the geophysical data base for the province has suffered from the lack of a provincial geophysicist. Unlike geochemical data, no new regional geophysical data has been acquired by or for the province in recent years. Regional geophysical surveys, usually airborne, are one of the basic tools required by explorationists and academics alike for both exploration target identification and geological interpretation. The availability of local (provincial) expertise capable of advising both the provincial and federal governments and the private sector in matters dealing with the acquisition and interpretation of all types of geophysical data is a must.

Recommendations

The existing geological, geochemical and geophysical data base in many areas of the Province is insufficient, incomplete or out-dated. Therefore it is recommended that bedrock mapping remain an integral part of the ongoing assembly of mineral resource data and that the year 2000 be set as a target date for having complete geological coverage of New Brunswick at a scale of 1:20,000 except for the Pennsylvanian areas where 1:50,000 would be adequate.

An ongoing program of geochemical data acquisition is recommended. Awareness and familiarity by the provincial geochemist of current and developing trends in the science is a must and is to be encouraged.

An ongoing program of geophysical data acquisition is recommended. The position of provincial geophysicist should be filled as quickly as possible by an individual conversant in practicalities of the science. Awareness and familiarity by the provincial geophysicist of current and developing trends in the science is a must and is to be encouraged.

It would be desirable to have a long range plan whereby the geological, geochemical and geophysical data base for the province was upgraded at predetermined regular intervals. This type of continuing program should be in addition to the more specifically targeted objectives which arise due to particular economic possibilities, academic interests, etc. As suggested previously, consultation between government, universities and the private sector would be beneficial in establishing priorities. This form of consultation would require some form of ongoing committee structure.

4.2 DEVELOPMENT, MINING AND PROCESSING

The mining industry in the province is well established with operations at various size levels. The larger operators have their own well qualified technical staff and generally utilize the most up-to-date technology available within the constraints of their "in place" plant and capital considerations. Although this group can perhaps in specific instances require technological assistance not available within their own organizations, on the whole they are relatively self-sufficient in the areas of mining and processing. Their concerns are directed more at the regulatory and other constraints to development and these will be addressed in the appropriate section so headed.

The smaller operations, because of their size, are not as well positioned with regard to in-house technical expertise or financial resources to take advantage of new technology or development opportunities. This group either individually and/or collectively, could benefit from technological assistance.

The area where improved technology would have the most impact, in terms of increased activity in the mineral sector, is in the development of known mineral deposits which currently lie dormant due to technical and commercial constraints. Significant reserves of both metallic and nonmetallic minerals and peat fall into this category. The obstacles in some instances appear to be overwhelming, however their resolution could certainly accelerate development significantly.

4.2.1 Resource Identification

Opportunities/Constraints

The natural resource potential of New Brunswick has only been partially developed and there are additional development opportunities that perhaps require promotion in order to stimulate interest.

What is required to stimulate this interest is an inventory of potentially marketable commodities including reserves, chemical and physical properties and possible market matches. Although this work is currently being done on a commodity by commodity basis, a more comprehensive inventory, available to interested developers would be more helpful.

Recommendations

It is suggested that a group be identified and formed from expertise within government to develop this type of inventory. Members of the group should be knowledgeable not only in resource definition, but also in developing, processing and marketing of a particular commodity. The inventory itself should be reasonably comprehensive and include not only the "traditional" resources currently under development, but extend to the more exotic metals and rare earths which are gaining prominence in the high technology industries. This study should point to some development opportunities which could then be presented to interested parties.

The group formed for the initial compilation should remain intact, perhaps as a committee whose task it would be to update the data periodically and to be available for consultation and selling of the opportunities available in the province.

4.2.2 Metallic Resources

Opportunities/Constraints

There are approximately 300 million tonnes of known massive sulfide reserves containing base metals in the Bathurst District. About a third of this total has combined Pb-Zn values averaging in the range of 12 percent, another third contains combined Pb-Zn in the order of 6 percent, with the remainder less than 6 percent. All current production is based on extracting the highest grade Pb-Zn (12%+) material while the lower grade reserves remain undeveloped.

The current producers are utilizing up-to-date equipment and technology. However due to the metallurgical complexity of the ore, only 70-75 percent of the mined metal value is recovered. This poor recovery is a major factor in constraining development of the lower grade deposits which are unable to absorb the revenue loss. Any improvement in the recovery would not only improve the financial status of existing operations and extend their life, but would stimulate development of new lower grade deposits as well.

Because the northeastern New Brunswick economy relies so heavily on Pb-Zn-Ag mining, the constraints to development if not addressed at an early date, have serious future implications. The higher grade reserves, currently sustaining the industry, will be exhausted in approximately 30 years and if there is no technological breakthrough to enable development of lower grade deposits, there will be some serious economic repercussions in the area.

Approaching this situation with a laissez-faire attitude by hoping technology will somehow be developed is quite risky. Particularly when one considers that many of the undeveloped deposits were discovered in the early 1950's and in the 35 intervening years technology has still not been able to improve metal recoveries significantly.

Another technological obstacle that requires resolution is the problem of process waste management. Mining operations by their nature generate metallic and chemical wastes that are detrimental to the environment. Therefore acceptable means of treating and/or storing these at reasonable cost must be achieved if the industry is to expand.

Recommendations

In order to accelerate development, or at least to maintain base metal mining at the present level, research will be required to improve the technology so lower grade deposits can be economically developed. Also, it will be necessary to establish a long range strategic plan, so that development produces a continuous economic benefit to the province.

Improving the technology is a difficult undertaking. Many of the metallurgical research centres worldwide have studied New Brunswick ores and attempted to overcome the separation difficulties using a variety of newly developed techniques. However none has been notably successful in developing an economically viable alternative process.

With this lack of success by numerous reputable research facilities, it is difficult to recommend an all out research assault by the province. However there should be a core of expertise that is able to track new technological developments that might be applicable to New Brunswick ores. Those considered to have potential should be evaluated thoroughly, utilizing the in-house research facilities, or be contracted out under the direction of the resident expertise.

A similar approach could be taken with regard to waste management. A core of expertise in the province should become knowledgeable in the technologies available and be able to act as advisers and/or researchers helping industry and government departments solve industrial waste problems. A cooperative approach at resolving these difficulties would accelerate development, particularly of smaller projects where "up-front" capital is so critical.

Currently New Brunswick accounts for approximately one third of Canadian zinc production and has at least one third of the known Canadian reserves in the proven-probable category as well as a third in the marginal reserve category.

New Brunswick is in the fortunate position of having maintained its net reserve situation, unlike other provinces where depletion has exceeded reserve replacement sufficiently to cause concern about the future of base metal mining in those jurisdictions.

This situation provides an opportunity for long range planning regarding the development of the known metallic resources. It is recommended that the province formulate a strategic plan for base metal development so that continuity of production can be maintained from lower grade deposits as the higher grade deposits currently in production are depleted. This may require not only technological advances but innovation stimulation via financing arrangements, taxation, power costs, regulations etc.

4.2.3 *Industrial Mineral Resources*

Opportunities/Constraints

Potash:

The potash industry contributed in excess of 100 million dollars to provincial mineral production in 1987, making it the second largest contributor to mineral value. In 1988 this sector's contribution increased to approximately 180 million dollars.

Published reserves, at the two operating mines are in excess of 300 million tonnes, sufficient for more than 25 years of operation at current production rates. Although accurate figures beyond those published are difficult to obtain, there appears to be potential for expanding the current operations as well as undertaking new developments such as the Millstream Deposit, if market conditions warrant. There is also potential for new potash discoveries, particularly in the Cumberland Basin.

As in the case of metal producers the potash operations utilize up-to-date technology in the extraction and primary processing of their ore. The somewhat irregularly shaped and folded deposits do present a mining problem and research into the most cost effective method of extracting the ore would be of considerable benefit. Approximately 30-50 percent of the available ore is currently being extracted. Also technology that would improve this extraction rate, plus the recovery of potash in the milling process would benefit the producers.

Other Industrial Minerals:

New Brunswick has significant reserves of undeveloped industrial minerals and there is opportunity for expansion provided markets can be developed and efficient production technology employed. The operators producing limestone, dolomite, silica, cut stone, etc., for the most part are small (less than 100 employees per site), however they use relatively up-to-date technology to produce their various products. From a technology perspective the major constraint is their limited ability to evaluate and take advantage of new technology particularly as it relates to new product development. Because of limited resources these smaller operations cannot maintain meaningful research and development programs.

Also regulations (eg environmental impact studies) which were formulated with large corporations in mind, impose constraints on small operators who don't have either the financial or technical resources to provide all the criteria required by a multi-level bureaucracy.

Recommendations

Potash:

Since potash is a significant portion of the New Brunswick mining industry, a certain level of technical support would certainly be appropriate. This should be directed at resolving problems unique to New Brunswick deposits and investigating opportunities specific to in-province operators. For instance, the irregularly folded ore zones present unique mining challenges. Development of more efficient and economic mining methods capable of safely extracting a higher percentage of ore and/or developing more effective backfill placement, would improve utilization of ore reserves and extend the life of properties.

Similarly technological improvements in flotation, compaction and recovery would be beneficial to the processing side as would research into waste disposal.

It is difficult to recommend that government embark on mining research or similar such studies which are more properly the jurisdiction of operators. However, government can stimulate and perhaps participate with operators in trying to resolve specific problems. To do this, a nucleus of government staff knowledgeable in all aspects of this sector should be developed. This group's responsibility would be to liaise with operators and provide assistance where appropriate. Equally as important they would track new developments and evaluate opportunities specific to New Brunswick operations. If practical this group could have dual responsibilities covering both potash and other industrial minerals.

Other Industrial Minerals:

Since these operations, because of their size, cannot maintain research and development departments, a central facility staffed by people knowledgeable in this segment of the natural resource sector would be of considerable benefit. Such a facility would be able to track new technology and assist in evaluating its application to New Brunswick operations. This research could range from identifying stone, specific for ornamental stone products to crushing, sizing, analysis etc. for various crushed products.

There is a section within the Department of Natural Resources with responsibility for industrial minerals and this could be expanded to cover a wider range of activities designed specifically to expand production in the province.

The expanded section should also have the capability of assisting the smaller operators determine such things as the environmental impact an operation is likely to have and what action would be appropriate to mitigate any detrimental impact. This type of cooperative approach between developers and regulatory agencies would eliminate the confrontations approach which discourages development.

4.2.4 Peat Resources

Opportunities, Constraints

Of the 29,000 hectares of peat deposits identified in the province, approximately 3700 hectares, or 50 percent of the bogs with commercial potential, have been developed. This leaves substantial undeveloped reserves available for expansion of the industry, given favourable market conditions and competitive production costs.

Currently peat harvesting is restricted, on average, to a 38 day period in the summer and/or early fall of each year. This short production period translates into under-utilization of capital which in turn impacts negatively on production cost. A short production period also means carrying large inventories which add to these costs imposing further constraints on production.

In the processing of peat, equipment currently used in New Brunswick tends to break the long fibers. This affects sales since long fibers are generally more marketable than short ones.

Recommendations

In order to reduce the production cost of peat and thereby improve its marketability, new and innovative methods of harvesting, processing and packaging must be developed. Also research directed at developing new products and uses is required. The Peat Research Centre is the logical organization to carry out this work and should be given the mandate and funding necessary to accomplish this task. To insure that research undertaken is relevant to the industry, a board of directors, the majority of whom are industry representatives with the remainder government, should be appointed to direct activities of the Centre.

4.3 MANUFACTURING AND VALUE ADDED

4.3.1 Metallic Products

Opportunities/Constraints

Metallic production in the province was valued at approximately $480 million in 1987 and of this total 20 percent was marketed as metal while the remainder was sold in concentrate form. At first glance this situation would appear to provide an opportunity for value added in the manufacturing of the metal. There are however some formidable constraints in achieving this objective.

Zinc concentrate, which constitutes about 60% of the metal value produced in New Brunswick, is the largest component of unrefined material leaving the province. However, excess world refinery capacity, import tariffs on refined metal products, high capital cost of constructing a "new green fields" refinery and high power costs are some of the constraints that have made construction of such a facility unattractive.

Other concentrates such as copper, antimony, etc. do not appear to have sufficient volume to justify further processing in the province at this time.

Although lead is shipped out of the province in metal form, there could be opportunities for manufacturing products with a high lead component. Also further treatment of residues generated by the mineral industry could present opportunities.

Recommendations

With the expected decrease in zinc concentrate production in Canada, and the excess capacity that this will generate in domestic smelters, it is difficult to envisage construction of a complete new plant in New Brunswick. However there could be economic justification for partially processing the concentrate here and this approach should be thoroughly investigated. For example, building a zinc concentrate roaster in New Brunswick would add value to the zinc concentrate and produce by-product acid which could be used to expand fertilizer production or perhaps in some new industry.

Research into manufacturing products with a high component of lead metal is also recommended. With free access to the U.S. market manufactured goods would have tariff free entry and could possibly be produced in the province for distribution to an eastern North American market.

The mining industry generates numerous residue and waste products that are either stored or shipped out of the province for further treatment. It is recommended that an inventory of these products be compiled and research undertaken to determine if further treatment of these materials within the province is feasible. In particular, other uses of the large tonnages of waste sulfide material should be investigated. These have the potential to spawn a whole new chemical industry and their utilization would remove them from permanent storage where they will continue to be an environmental liability.

4.3.2 *Industrial Mineral Products*

Opportunities/Constraints

Potash:

At present several sizes of granulated potash fertilizer are being produced in the province to meet current market demands. The major constraint for this product is market, therefore the best opportunities lie in expansion of the market. Also there is a requirement developing for new products such as crystallized potash for solution fertilizers, higher grade material known as soluble or low sodium (62.5% K_2O) and refined KCl (63.15% K_2O) products to be utilized in the potassium hydroxide (KOH) potassium sulfate (K_2SO_4), and calcium chloride ($CaCl_2$) industries.

The potash industry generates large quantities of by-product salt (NaCl) which for the most part must be stored or discarded. Better utilization of this product presents opportunities both in terms of increased revenue to operators and by reducing the environmental liabilities.

Other Industrial Minerals:

Minerals such as limestone, silica, dolomite, etc. are for the most part sold in their end use form. There may be additional markets for more specialized materials such as fillers, extenders, etc. which can be investigated in terms of local manufacturing capability and economically available markets. Also the manufacture of silicon compounds may present some opportunities.

Similarly the cut stone industry currently markets its product in finished form. Expansion in this sector depends on increasing market size and diversification into new products.

Recommendations

Potash:

The only opportunity for value added in potash appears to be in producing a crystallized higher grade soluble product (62.5% K_2O) and for refined KCl and potassium sulfate (K_2SO) products. A study into the economic viability of producing these should be undertaken.

Studies into the uses of salt and salt by-products should also be undertaken. In particular processes using a combination of salt with other locally available natural resources should be investigated.

Other Industrial Minerals:

There is staff in the Department of Natural Resources and Energy tracking development of industrial minerals. To make this part of the department more effective in terms of stimulating new development, it is recommended that a regular seminar be held between developers and government specialists to discuss new products, uses and processes.

Similarly the department could assist the stone cutting industry by making it aware of new technology, industry trends etc.

4.3.4 Peat Resource

Opportunities/Constraints

Value of New Brunswick peat production exceeds $25 million annually. Most of the peat is sold as a soil conditioner for the horticultural industry. A minor amount is utilized in peat pot production and a growing market is developing for replacement soils. Opportunities lie in developing new products to augment the diversification into peat pots and replacement soils. As an example, pelletized peat additions to fertilizer may be a potential new use. However research is required to determine the affect this combination might have both in terms of changing plant nutrient availability and providing the organic component necessary in soils. Other similar opportunities are certainly present.

Recommendations

Research into product development with increased added value is required and should be undertaken at existing research facilities in the province. There should be firm objectives with respect to this research to insure that product development is the major goal. As suggested previously, a committee consisting of industry and government representatives should guide this work to ensure that objectives are achieved. The Peat Research Centre would be the logical organization to initiate development of new products and uses. However other institutions like the Department of Agriculture Research Centre could become involved particularly in agriculture related research.

4.4 MARKETING

4.4.1 Current Status

Markets for commodities produced by the mineral industry can be divided into two broad categories, those that trade on the world market and those that are more regional in nature. Metals and potash generally fall into the former category while most industrial minerals, other than potash, are more regional with respect to markets. Peat is marketed regionally, however a growing percentage is being exported outside North America.

Large corporations have marketing departments and should not require assistance in selling their product. Small producers such as those involved in industrial minerals (except potash), cut stone and peat, generally might not have the resources to adequately assess market opportunities and therefore could benefit from market identification.

4.4.2 Metals

Opportunities/Constraints

As suggested in the foregoing, metals trade in the world market and consequently only limited influence can be exerted on either demand or price. Opportunities lie in making the product competitive through technological innovation and having a reasonable regulatory and competitive tax environment.

The government should remain knowledgeable about the marketability of value added metal products and be aware of new uses and opportunities. As an example, a review of all current lead uses and markets might indicate a potential marketing opportunity for New Brunswick. A similar approach could be taken with respect to other metals, waste and by-products.

Recommendation

Access to world markets can be maintained only if producers remain globally competitive. To achieve this goal producers must strive to keep costs down through efficient management and innovation in both production technology and new product development. It is recommended that the latter be stimulated by research tax incentives and possibly by government participation in the early stages of high risk research programs.

Since government intervention is becoming an increasing factor in production costs, it is the responsibility of government to insure that a reasonable regulatory and tax environment prevails as well as providing services such as electric power at competitive rates.

It is also recommended that government take greater advantage of offset agreements when purchasing out-of-province items. These could be linked to resource product supply contracts.

Government should maintain up-to-date information on market opportunities for mineral resource products and particularly for value added products and by-products.

4.4.3 *Industrial Minerals*

Opportunities/Constraints

Potash:

Potash companies also trade in a global environment which cannot be readily influenced. Opportunities here appear to lie in the marketing of new products and possibly products derived from by-product treatment.

Other Industrial Minerals:

The smaller industrial mineral operators which produce limestone, silica, dolomite, cut stone, etc. generally sell to a relatively confined regional market. One of the major factors restricting a broader distribution of this product, is the cost of transportation which is a significant portion of product price and a constraint to expansion. Opportunities appear to lie in adding sufficient value to the various products to reduce the impact of transportation costs, and to develop markets for new products not currently being supplied.

Recommendations

Potash:

There may be potential for increasing New Brunswick's share of world potash markets due to the strategic, near tide-water location of producers. However for this advantage to be effective potash producers must be globally competitive and the same recommendations as those presented for metals would apply.

There may be opportunity for increasing sales to developing nations. Since many of these obtain assistance, in one form or another, from the Canadian tax payer, perhaps the agencies administering the assistance programs, particularly for agricultural development, should actively promote use of Canadian products.

Also market research into the demand for new potash products, outlined in a previous section, could lead to new market opportunities.

Other Industrial Minerals:

As suggested previously most producers in this category are small and have limited resources to investigate market opportunities, particularly new ones. Therefore it is recommended that government take a leading role in undertaking a comprehensive study of potential markets for New Brunswick commodities, similar to the recently completed "Aggregate Study." This compilation should include quantity, quality, competitive position etc. of the commodity required plus any other pertinent data necessary to evaluate the economic viability of supplying the potential market. An advisory committee of industry and government representatives to review and guide this study would be desirable.

Also it is recommended that wherever possible government promote the innovative use of indigenous materials. This could be in the form of additives to asphalt such as lead, concrete highways, granite curbing etc. Also promoting the long-term value of natural stone as a building material could stimulate this sector.

4.4.4 Peat

Opportunities/Constraints

Peat, like several other industrial mineral commodities, is very sensitive to transportation costs. These are a major constraint to wider distribution and increased markets for "raw" horticultural peat which accounts for 90 percent of all shipments. Any reduction in transportation costs would proportionally increase the market providing expansion opportunities.

Since raw peat is so cost sensitive to transportation, greater opportunities may exist in added value products.

Recommendations

It is recommended a study be undertaken to investigate transportation alternatives for peat. This should be a wide ranging investigation evaluating all factors from packaging to ship "slurry" transport, to improved road transport.

Also it is recommended that a comprehensive study be undertaken to determine new markets for products currently made, and potential markets for new products. With respect to the latter it may be desirable to have a group investigating new products and/or uses for peat for the purpose of creating new markets.

4.5 *RESEARCH AND DEVELOPMENT*

Specific research recommendations related to particular aspects of the natural resource industry have been previously discussed under the appropriate sections of this report and will not be repeated. Discussions here are directed at an overall view of research in the province and changes that could be beneficial.

The overall goal of government should be to formulate an objective oriented, action plan in which Business, Government, Labour, and Research/Education Institutions form an effective partnership and collaborate to carry out overall strategies and priority initiatives. This collective partnership will require collective agreement and support by all those involved.

As part of this collective involvement, every effort should be made to use the research and educational facilities within the province utilizing their specialties and capabilities as much as possible and avoiding duplication of effort. In a small province like New Brunswick this is particularly important from both a practical and economic point of view. Within this framework there should be nuclei of individuals, at the various agencies, with expertise in sectors of the industry that are significant contributors to the provincial economy or have the potential of becoming so. These groups should be provided with appropriate facilities and an adequate level of funding to achieve predetermined objectives which can be of an immediate nature or relatively long-term (20 to 30 years). With New Brunswick's undeveloped resource position, any research stimulated development would have an immediate and positive impact on the economy of this province.

Opportunities/Constraints

Because there has not been a well defined strategy with respect to mineral development, R&D work has not enjoyed consistent or stable support from either industry or government. This has resulted in a fragmentation of research activities which are often done in isolation, without regard to the larger objective or linked to the development system they should be supporting. Linkages to centers of expertise outside the Province are at best intermittent, which can result in lost opportunities to complement and build provincial strengths and capabilities.

This fragmentation and reluctance to communicate reduces the free flow of information resulting in industry often being unaware of research in progress and unfamiliar with the research organization. The latter situation results in contract work leaving the province further deteriorating provincial capability.

The communication gap also contributes to the perception by industry that the R&D institutions have an overly academic orientation.

Provincial facilities like the Research and Productivity Council and the University of New Brunswick have mineral oriented research capability. The University of Moncton through its association with the Peat Research Centre has the capability for peat research. However the lack of well defined research objectives, and the funds to pursue these, limit use of these facilities and impact negatively on future development. It cannot be emphasized strongly enough that research, even without guarantees of success, can produce significant economic benefits.

Although U.N.B. can contribute to research on a multidisciplinary basis, of particular interest to the mining industry is the re-establishment of Industry/Government/ Department of Geology interaction which has diminished in recent years for a variety of reasons. Geological research into the formation of economic mineral deposits is essential to a healthy industry and must be encouraged if opportunities are to be realized.

One of the problems inherent in attempting to co-ordinate an effective research and development program in New Brunswick is the diversity of the mineral industry. This diversity requires a multidiscipline Department of Natural Resources and Energy with a staff knowledgeable in various sectors. Having such expertise would improve the Department's ability to evaluate the province's mineral development potential, and provide knowledgeable contacts to industry both in terms of assisting resident operations and attracting potential developers.

This diversity also creates difficulties in setting priorities and allocating funds for research however these could be overcome by having the research groups co-ordinated by a central agency.

Another inherent problem in mineral development is the government structure, which has given the Department the combined responsibilities of both a regulator and a promoter. Some innovative changes should be able to resolve the conflicts that the present situation creates.

Recommendations

There is a need to co-ordinate research and development in the province and to establish program objectives designed to stimulate industrial development. This can be accomplished through a central coordinating agency that can insure a free flow of information and encourage linkages both within and outside the province.

To familiarize all parties with in-province research capability, it is recommended that government have a directory (similar to that for Metal Works) compiled and published. The directory should list all private and public organizations involved in R&D and summarize the specialties and range of activity of each.

Once long-term project objectives and a strong applied program for the mineral industry have been established, an adequate level of maintenance funds should be allocated to achieve the desired goals. The funds should be from both Provincial and Federal/Provincial Agreements.

A second level of research directed at higher risk objectives should be established and promoted within the Province. These could be undertaken by research "consortiums" consisting of partnerships between Government and private concerns. To make these arrangements attractive, the government should assume a disproportionate share of initial costs, utilizing the various federal/provincial funds available and then have a staged phase-out of their participation. This would provide leveraged research for any high risk programs ranging from bench scale and/or pilot plant testing to development of new processes. Imaginative programs adequately funded would stimulate research within existing provincial facilities thereby creating new opportunities.

The Geology Department of the University of New Brunswick has initiated steps towards establishing a Chair in Economic Geology. This is a positive step towards the integration of research and development and should be supported by funding from both Provincial and Federal governments.

It is suggested that the structure of the Department of Natural Resources and Energy be modified to reflect the diversity of the industry and where appropriate, personnel with expertise in a particular aspect of the industry, be added. Also a clear definition of responsibility of these groups is essential. Research and development would be accelerated by having expert groups who could provide research guidance and assistance in overcoming problems related to specific developments. Appendix A lists a possible distribution of research responsibility within government agencies.

Also it is suggested that the present DNR&E structure be re-examined to determine the advantages versus disadvantages of separating the regulatory functions from service, research and promotional activity.

The task group on Minerals and Materials Technology should be maintained in some form to provide industry input regarding development in this sector. This group could meet on a quarterly basis and make annual submissions in the form of an update of the current report.

4.6 EDUCATION AND TRAINING

Opportunities/Constraints

Vocational Training

Despite the importance of the mining industry to the overall economy of the province, very little, if any, education in various aspects of mining and mineral development is offered at the vocational level. Most of the training is done "in house" by the mining industry itself and commonly, experienced miners, when needed, are brought in from outside New Brunswick. From a provincial perspective, concerned with job opportunities and employment for New Brunswickers, this situation is presumably not attractive and might also be a costly one for the mining industry.

To improve on education and training for those wishing to pursue a career at the vocational level in mining, we feel that a valid case can be made for establishing a course-apprenticeship program at one of the Community Colleges in the province. For its central location with respect to Bathurst, St. George, Sussex, Minto and Nova Scotia a logical selection could be Moncton Community College which already has in place a Civil Engineering Technology program with mining surveying as an option.

The benefits of an educational and training program would potentially lie mainly in the realm of:

(1) improved mine safety,
(2) improved cost effectiveness in "on-the-job" training,
(3) an improved public profile of the mining industry,
(4) improved participation rate by New Brunswickers in the mining industry,
(5) improved public awareness of the mining industry and its importance to New Brunswick,
(6) more positive career identification.

Public Education

Industry groups (e.g. CIM) are interested in and do conduct public education activities. Similarly, the Department of Natural Resources and Energy is involved in such activities. Closely coordinated activities in education by government and various interested industrial organizations is warranted.

Recommendations

Vocational Training

The Task Group recommends that an education and training program be established and centered on the apprenticeship concept leading to:

(1) **Mine Operator**

The course leading to a mine operator's diploma would take two years and involve blocks of time spent in the classroom alternating with blocks of time spent in "on-the-job" training. The curriculum content could include mining techniques, mine safety, first aid, mine lay-out, core and blast hole drilling, ventilation, blasting, use and handling of explosives, equipment use and maintenance, quarrying techniques, etc.

(2) **Mining Technician**

The first two years would be the same content and format as that for qualified miners (see above) with an additional one year of education and training in drafting, microcomputers, metallurgy, mine surveying, environmental aspects, rocks and minerals, etc.

(3) **Mill Operator**

The course leading to a mill operator's diploma would involve blocks of time spent in the classroom alternating with on-the-job training. The curriculum content would include crushing, milling, flotation, drying and materials handling along with maintenance and safety.

(4) **Mill Technician**

The first two years would be the same as a mill operator with an additional one year of education and training in material balances, flow sheets, metallurgy, computers, drafting, hazardous materials handling, environmental aspects etc.

(5) **Exploration Technician**

The two year course-apprenticeship program leading to qualification as an exploration technician would emphasize mine and surface exploration techniques with an emphasis on geophysics and geology. The curriculum would be centered on data and sample collecting, prospecting, surveying, drafting, microcomputers, staking, reading of geological reports and maps, aerial photograph interpretation, equipment maintenance and repair, claim staking and assessment work, filing of assessment reports, etc. A certified exploration technician should be capable of operating as an independent prospector.

Public Education

1. Government should coordinate the promotion of the resource industry with other organizations involved in education activities for the mineral industry.

2. Government should prepare audio visual programs suitable for grade or high school students designed to arouse their interest in earth sciences. These programs such as videos, would hopefully make our students aware of career opportunities related to the mining industry.

3. Government should support activities where universities and research and development groups would jointly promote workshops, seminars, etc. on geophysics, geochemistry, remote sensing GIS, etc. and provide support for invited speakers in areas of interest to the mineral industry.

4. An education program should be established to provide general interest presentations on the mineral industry to specific industrial groupings to get them involved as secondary producers of resource commodities or suppliers of manufacturing goods to the mineral industry.

5.0 *REGULATORY AND OTHER OPPORTUNITIES, CONSTRAINTS, RECOMMENDATIONS*

Although the primary mandate of this Task Group was to identify technological opportunities, it became obvious after several meetings that regulatory and other constraints were viewed by industry as equally significant impediments to development. Therefore it was considered appropriate to include a section on this aspect, particularly since the overall objective is to stimulate development of the mineral industry thereby enhancing employment opportunities and revenue generation in New Brunswick.

5.1 *DNR&E ORGANIZATION*

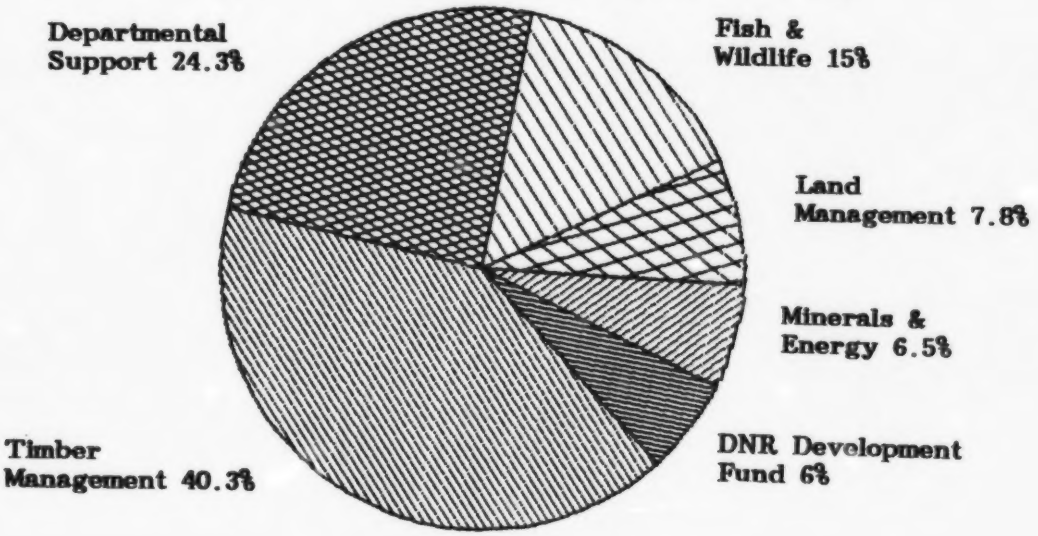
Opportunities/Constraints

Based on the allocation of budgetary spending it appears that mining has a low priority within government particularly when compared to forestry and this is viewed as a serious constraint to development. For instance, in fiscal 87-88, out of a total DNR&E budget of $44 million, forestry received $19 million while the minerals section received $2.7 million. This means that minerals, which constitute in excess of 30% of the combined value of forest and mineral production, receive 12% of the forestry-minerals budget. Table 2 lists other comparative statistics which further illustrate the imbalance that exists between the forestry and minerals sectors. On the basis of the 1989-90 estimates shown in Figures 6 and 7 the situation does not appear to be improving significantly. This data reinforces the perception that provincial investment in the mineral sector is not proportional to its economic contribution.

TABLE 2
(Department of Natural Resources and Energy Data)

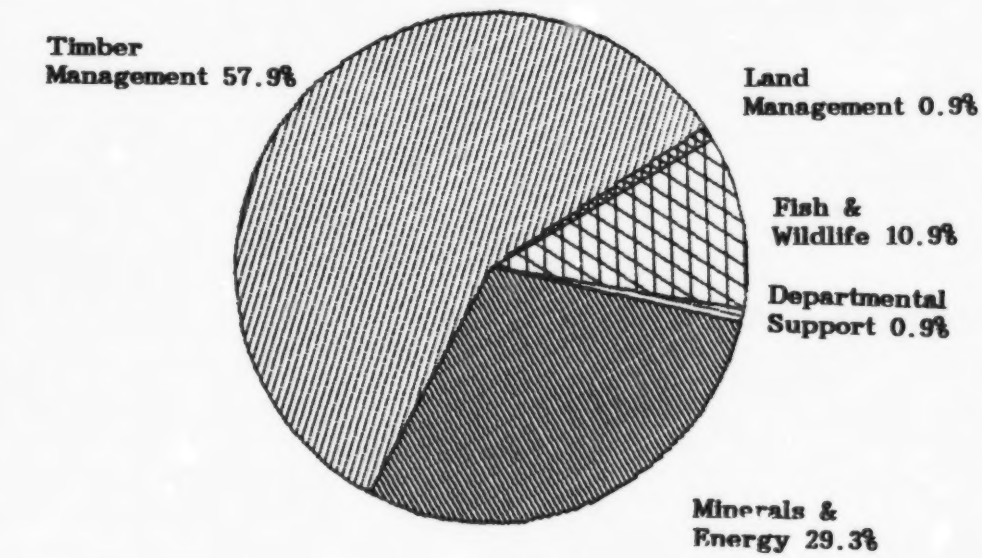
	F Forestry	M Minerals	Ratio F:M
Value of Production 1987 ($Millions)	1709.4	700.7	2.4
Corporate Taxes Paid 1984 ($Millions)	7.9	4.4	1.8
Revenue to DNR&E 1987 ($Millions) (MMTA, Royalties, etc.,)	21.9	10.4	2.1
Industry Employees 1988 (Thousands)	15.0	5.0	3.0
Provincial Budget 1987-88 ($Millions)	19.0	2.7	7.0
Government Employees 1988 (Per. Yrs.)	260.0	52.0	5.0

FIGURE 6
NB Department of Natural Resources & Energy



Budget 1989-90

FIGURE 7
NB Department of Natural Resources & Energy



Revenue Estimates

This situation in part is a result of a combined ministry where forestry has obviously been more influential. The consequence is an inability of the Mines Branch to provide the research impetus necessary to adequately stimulate new developments.

Recommendations

The appointment of a Minister of State for Mining is considered, by the industry, as a positive step provided the Minister is given the responsibility and authority commensurate with the mineral sectors contribution to the Provincial economy. Equally important is a fair and equitable distribution of government funding, to insure that each sector can provide the services necessary to expand and promote development. In fact, a good case could be made for providing the minerals section with a disproportionately larger share of funding, since this sector has significantly more growth potential than most industries in the province including forestry.

It is recommended that the structure of the Department be modified to include expertise in all phases of the mineral industry ranging from exploration and mining to processing, marketing etc. In particular the Mines Branch should have expertise in those sectors of the mineral industry that are significant contributors to the provincial economy.

Responsibilities of this group should include promotion of the mineral industry in all aspects including long range research to resolve problems inhibiting development or directed at improving the competitiveness of New Brunswick resources. Although some of this would traditionally be viewed as the responsibility of industry, provincial involvement is justifiable on the basis of differing priorities. Corporate development priorities may be made on a world scale which could relegate a particular development to limbo for years whereas it may be of top priority to a province.

Also it is recommended that the organization of the Department of Natural Resources and Energy be reviewed to determine the most effective structure for discharging its responsibility. This should also extend to related departments such as Environment and the Occupational Health and Safety Commission to determine if overlapping and/or duplicating responsibilities can be rationalized and perhaps re-assigned for more effective administration. As with most of the other recommendations it is suggested that input from all concerned parties be obtained before action is taken.

5.2 *ACTS AND REGULATIONS*

Opportunities/Constraints

The various Acts and Regulations, dealing with Mining, Occupational Health and Safety, Environment, Land Use, etc., that have proliferated in recent years, have become very complex, making compliance difficult and administration tedious. This complexity results in jurisdictional ambiguity, or at least trepidation, in addressing differing interpretations of regulations, particularly those related to the Mining and Environmental Acts. This situation aggravates the problem for developers attempting to determine the proper course to follow when seeking approval for a new project.

The net result of this situation is a turn-a-round time of up to 18 months to obtain approval. Lengthy delays and uncertainty are negative factors for new projects that may wish to take advantage of short term positive conditions affecting financing, construction, markets, etc. While large companies have the ability to absorb some of this negative impact, it can be deadly for the smaller operators who generally have limited technical and financial resources. Consequently this situation seriously restricts the activity of a group that provides a significant proportion of new jobs in the province.

Recommendations

A concerted effort should be made to simplify and consolidate all Acts and Regulations pertaining to mining activity and to clearly define jurisdictional responsibility. Re-organization of departments as previously suggested might facilitate this process. From an industry perspective it would clearly be desirable to deal with one department and this should be attainable with some innovative restructuring.

In order to keep regulations current with changing conditions there should be regular periodic reviews done in consultation with all concerned parties. Any regulatory changes should be subjected to a cost-benefit analysis to ascertain their impact with respect to industry and government.

One of the major objectives of any contemplated changes must be to streamline the project approval process so that the period required to obtain all necessary approvals can be shortened to an absolute maximum of 6 months.

To accomplish this, a selected group of individuals, taken from appropriate departments, should be assigned the responsibility of expediting this process and reconciling any duplicity or jurisdictional differences that may arise.

Also a critical path flowsheet should be developed to streamline the approval route and to educate everyone on the route and required timing. Definite commitments to the established time frame should be given and adhered to.

5.3 *MINING ACT*

Opportunities/Constraints

The current laws governing the staking of mineral claims in the province are subject to potential conflicts between stakers and landowners. The present requirement of placing posts and establishing boundary lines around each claim is difficult, inefficient and is rarely executed in the legally proscribed manner.

Claims staked in the province have averaged 4040 per year between 1981 and 1988 at an estimated annual cost of $400,000.00. These claim acquisition costs are lost to productive exploration and this represents an annual loss to exploration expenditures of 3 to 4 percent. Approximately 70 percent of the claims staked are not renewed after the second year suggesting that sufficient work was completed to eliminate the area from consideration, or that insufficient work was done to satisfy the renewal requirements. The former situation results in a significant loss of information to the public domain while the latter ties up ground unnecessarily. Both limit exploration opportunities.

Recommendations

The current laws governing staking of mineral claims in the province should be changed to encourage more staking by lowering exploration cost and by lessening potential conflicts between companies and landowners. Map staking in other provinces has been successful in eliminating such conflicts and it is recommended that it be implemented in New Brunswick.

To insure that the savings realized by map staking are invested in productive exploration, it is recommended that an exploration performance bond be required for every claim recorded (eg $50.00 per claim in Labrador, $160.00 per claim in Alberta). These bonds or cash deposits would be refundable upon completion of a specified amount of work. So as not to impose restrictions on a prospector who may have difficulty with the guarantee, the deposit requirement could be waived for some minimum number of claims (less than 10) within a specific time period like one year.

The changes suggested would eliminate staking conflicts, direct unproductive staking funds into productive exploration. Also the performance bond refund would require submission of proof of work, which would encourage more reporting, thereby significantly increasing the geoscientific data base. This will require extra effort by explorationist and more thorough monitoring by government to insure that submissions are factual, however the information gained will more than offset any hardship imposed by this change.

5.4 *ENVIRONMENTAL ACT*

Opportunities/Constraints

Without question one of the major constraints to any development today is related to environmental costs, both present and future. As an example, lengthy delays in obtaining project approval, add significantly to "up-front" costs and can be a critical factor in the success or failure of a particular operation. Also, the seemingly confrontational approach which often develops between industry and regulators does little to alleviate any problems that arise. The latter situation, which sometimes gets media coverage, further exacerbates the problem and ends up reinforcing the negative attitude the public already has concerning development of mineral resources.

Recognizing the seriousness of effects of industrial and other human activities on the environment, is a relatively recent phenomenon which is continually evolving. Therefore it is understandable that neither industry nor government has all the solutions. This presents an opportunity for research into developing processes which are environmentally acceptable by determining the most practical means of disposing of harmful by-products, purifying process water, cleaning up air emissions etc.

Recommendations

Since environmental constraints are becoming such an important consideration in project development all aspects warrant review. In particular a means must be found to shorten approval procedures and to develop a cooperative approach between industry and government in solving problems which are certain to arise. To facilitate this process a critical path flowsheet for environmental approval should be formulated and in inter-departmental committee formed to assist applicants through the approval process.

It is recommended that an independent centre of expertise, that would provide assistance to the mineral industry in environmental matters, be established. This centre should be equipped to do research and act as a liaison group between government and industry.

5.5 *TAXATION*

Opportunities/Constraints

Taxation in any form impacts the income of an operation directly acting as a variable constraint depending on the level of imposition. As with other regulations the tax environment should be periodically reviewed, to determine its impact on the industry and more particularly to assess the effect it has on the competitiveness of that industry.

Provincial taxes which negatively impact development include the royalty levies which must be paid regardless of profitability. Also the selective and often arbitrary imposition of sales tax on items that relate to production is a constant irritant.

With respect to the latter, in October of 1987, the Provincial Government brought forward new sales tax legislation which, at the initial audit stage, is being interpreted in a way that makes taxable many items which were previously exempt.

Types of items previously exempt and now classed as taxable fall in the following categories (this is not by any means a complete list and will vary from Company to Company):

a) Underground Ventilation - fans, brattice, vent tube, etc.
b) Mine Dewatering - pumps, pipe, valves
c) Backfill and Tailings - now taxable after the point where it departs from the process rather than being exempt to the first point of disposal
d) Underground jeeps, personnel vehicles, service vehicles, service and support equipment
e) Safety equipment, mine lamps, etc.
f) Rock Mechanic instruments and equipment
g) Grinding media
h) Equipment supports, etc.
i) Service Shaft - hoist, cage, cables, etc.

The interpretation presently being made (audit Level) comes as a major shock as the changes and the cost consequences are considerable. The shock stems from the fact that most believed the new legislation was to accomplish two things: (i) to legalize the former "Guidelines"; and (ii) to ensure that structural steel and other equipment support structures (exempt under federal statutes) were subject to provincial tax.

Changes in interpretation as outlined above have the same effect as increasing the tax rate, this practice making projects already in operation less viable and discouraging new industry from locating in New Brunswick.

At the municipal level there should be a reassessment of property valuation techniques, since mining and milling facilities are project valuable only, and do not appreciate with time. In fact they decrease with time as the reserve is depleted.

Federal taxation policy in recent years appears intent on reducing any incentive to the mineral industry in spite of its often stated objective of encouraging regional development in areas where mining activity usually occurs. There is ample opportunity to formulate tax policy that would promote mineral development and the provincial government should take the initiative in advocating this.

Recommendations

It is recommended that the province re-evaluate its tax policy in terms of the fixed royalty and consider a royalty related to profitability and a royalty free period after start-up.

To encourage development, sales tax should be eliminated on all non-production equipment utilized for development or testing of new mine, mill and processing equipment.

The interpretation of the new 1987 provincial sales tax legislation is presenting a very significant deviation from that under which the economics of several properties were based, and on which new industry could be attracted. This interpretation should be revised to reflect the former understanding, as the present provincial tax rate is already the second highest in Canada and inclusion of additional items into the taxable category changes the rules on which projects became realities, and on which new projects will locate here.

Municipal taxation rates on mining structures should be based on an assessed value related to the productive life of the mine. This assessed value should decrease over time as the reserves are depleted.

Since most mineral related activity occurs in the less developed parts of Canada where governments allegedly try to promote development, an obvious way to stimulate activity is with an innovative tax structure. The provincial government in conjunction with the federal authorities should attempt to formulate a tax system that would encourage all aspects of mineral development, perhaps based on regional needs and potential opportunities.

5.6 *ENERGY*

Opportunities/Constraints

Mining and processing operations are generally energy intensive and our climatic conditions add to these energy requirements. High energy costs in New Brunswick continue to be a development constraint. For example, a plant requiring 60 megawatts of electricity at a 70% power capacity factor, would cost a New Brunswick operator $55 million more to operate over a 20 year period, than a similar plant located in Quebec.

Recommendations

A reduction in power costs to levels more competitive with other Canadian jurisdictions would provide an additional incentive for increased industrial activity in the province.

There is legitimate rational for having a multi-tier rate system based on generating capacity utilization. Users with fluctuating power needs that required high generating capacity for short peak periods should pay a higher rate than users who have a relatively steady demand and consequently make full use of generating capacity.

5.7 *ASSISTANCE PROGRAMS*

Opportunities/Constraints

There has been such a proliferation of assistance programs administered by different agencies, that it has become virtually impossible for anyone to keep abreast of these. The mineral industry is certainly unfamiliar with many of the incentive programs, and with the various departments that administer them. There is even a certain degree of reluctance to get involved because of the bureaucratic red tape and lengthy response time required prior to approval.

The ability to direct available research funds to in-province facilities also has its limitations, particularly for testing at the pilot plant level. Although it may be impractical to establish such a facility in New Brunswick, an organization such as RPC, with proper funding, could specialize in research directed at resolving specific problems that impact on development here.

Recommendations

If the objective of assistance programs is to create long-term viable employment in New Brunswick, then these programs should be targeted on industries that have the best chance of succeeding and creating long-term employment opportunities. Only a small portion of the funding should be made available to high risk projects or those that have limited, long-term impact on the economy.

Rigid criteria should be established with funding allocated primarily to projects that have wealth generating potential. For instance investment in research leading to development of a new mine and/or metallurgical complex would have long term spin-off effects meeting this criteria whereas funding, locally used, recreational facilities may not qualify.

It is recommended that support be provided to in-province process testing facilities at a bench scale and if warranted at a pilot plant level.

5.8 *TRANSPORTATION AND INFRASTRUCTURE*

Opportunities/Constraints

Transportation is generally a significant factor in the exploration, development, production and marketing of mineral products and consequently a good road system is essential if this industry is to prosper and expand. The fairly extensive forestry road network provides reasonable access for preliminary exploration work. However when a project reaches the development and/or production stage, and requires a site access road, the government is reluctant to provide this. The philosophy appears to be that developers should bear the cost of these roads even though they become public thoroughfares in time. The cost of providing this infrastructure can be a constraint to development by increasing the start-up capital required for a project.

For low priced commodities such as peat and some industrial minerals, transportation costs dictate the limits of the market area. These products, in particular, require a good road network and the poor quality or lack of some basic corridor roads in New Brunswick is one of the major constraints to mineral development.

Most base metal products and potash move by rail and/or ocean transport therefore these become important factors, directly affecting their competitive position. Disruptive work practices in port operations can cause unnecessary expense through ship demurrage etc., and if these become common occurrences it will negatively impact development. Similarly rail cost and reliability of service are important considerations.

Recommendations

It is recommended that government continue to provide reasonable access to forestry roads to mineral exploration and development personnel. Also government should encourage private companies to provide similar freedom of access.

It is also recommended that government review its policy on building site access roads to operations that are being developed for production. Parameters can be developed to avoid nuisance requests for such roads, however legitimate operations with long-term potential should have public access roads of reasonable quality.

With regard to industrial minerals and peat, the necessity, of a high standard, limited access highway network, without seasonal weight restrictions, is obvious. In particular it is recommended that reconstruction of Highways 8 and 11 be accelerated and that Highway 865, providing access to the Denison potash operation, be upgraded to a level exempt from seasonal weight restrictions. Also "Highway" 180, between Bathurst and Saint Quentin, should be upgraded to an all season, hard surfaced road without seasonal restrictions. This would provide an alternate east-west route, with limited topographic relief, capable of becoming an alternate trucking route from Edmundston to Moncton thereby reducing traffic on the Trans-Canada Highway.

As shown in Figure 8, this road would also provide access to the newly opened Caribou Mine, two new mines presently being developed on the Murray Brook and Restigouche deposits and the Armstrong dolomite deposit. Development of the dolomite has been delayed several years because the road is sub-standard for continuous haulage to Maine which is the major market for this resource. The peat industry, of the Acadian Peninsula, would also benefit from completion of this road which would provide them with more direct access to the U.S. market.

Port loading costs and wharfage fees are a significant portion of ocean transport and it is recommended that measures be taken to reduce these costs significantly. Lowering these could provide stimulus for moving lower valued commodities such as peat and industrial minerals through one of the under-utilized New Brunswick ports.

FIGURE 8

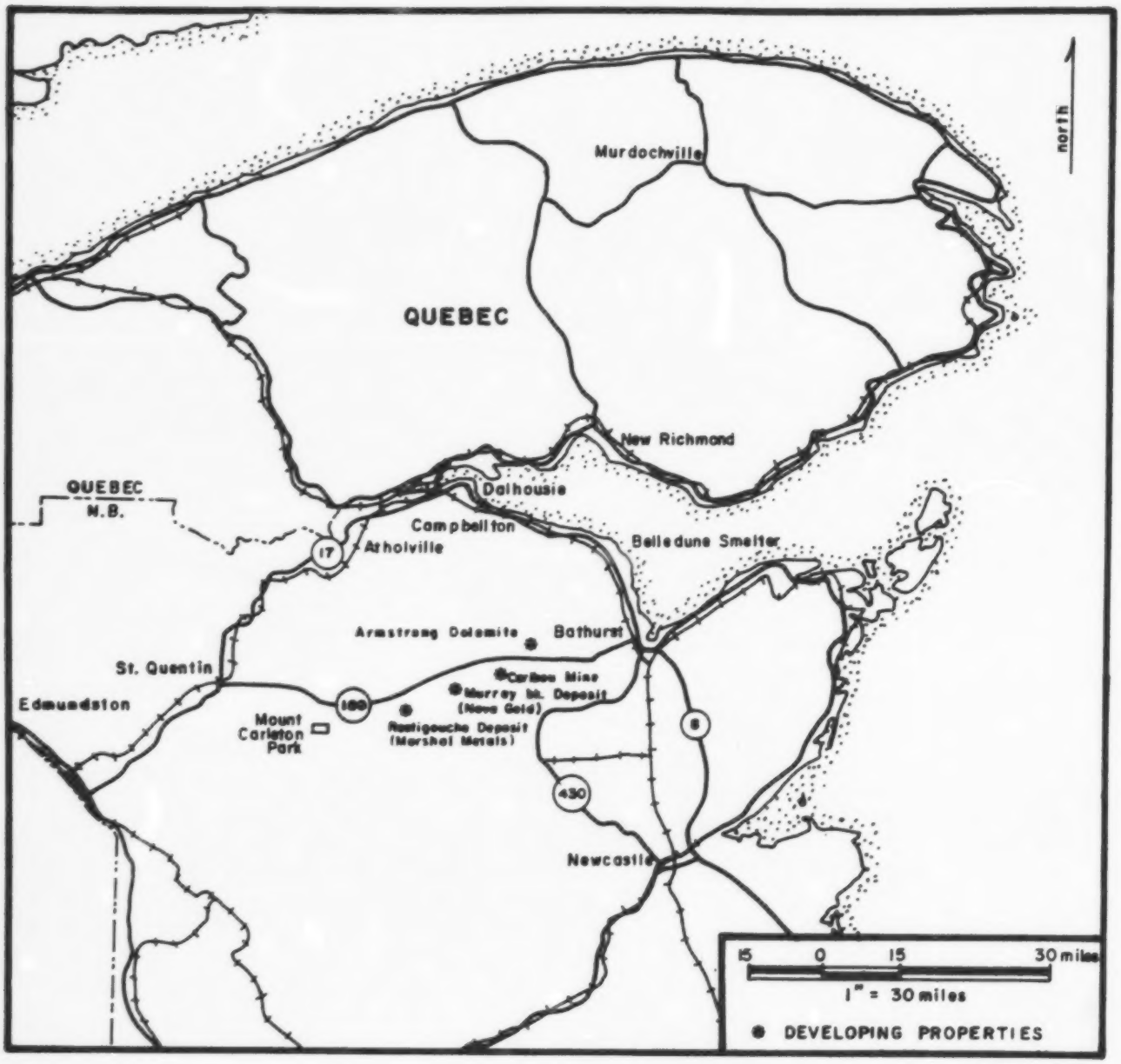


FIGURE 8

PLAN OF BATHURST - ST. QUENTIN ROAD

FIGURE 9

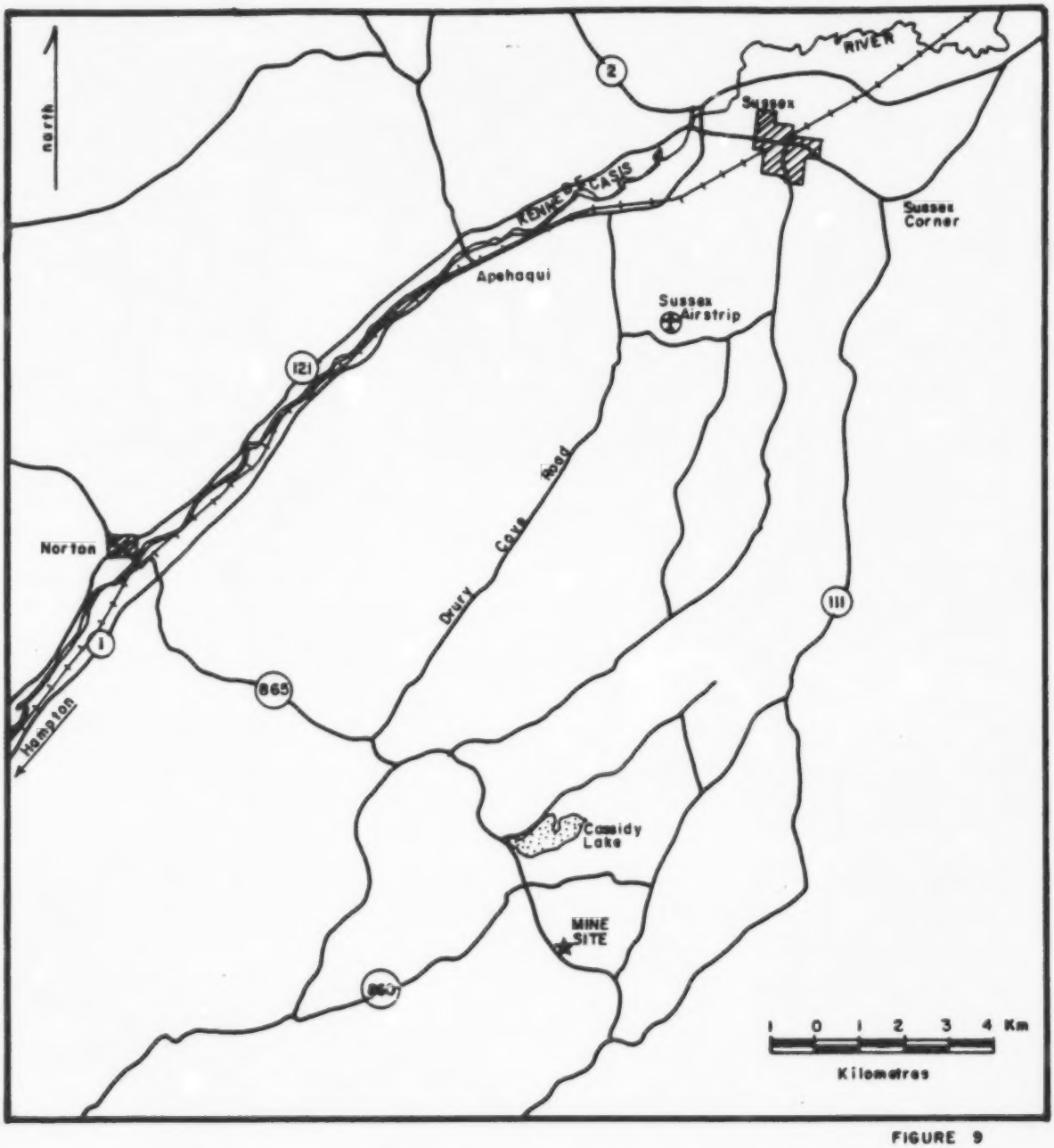


FIGURE 9

PLAN OF ROUTE 865, NORTON N.B.

APPENDIX A
SUMMARY OF
OPPORTUNITIES FOR TECHNOLOGICAL INNOVATION

Activity	Science or Technology Involved	Anticipated Innovation	Industry Advantage	Kind of Technological Change	Lead Agency
Exploration					
Basic theories	geology, deposit formation	new concepts	major; new & better deposit	major;	DNR&E&UNB
Geophysics	geophysical instrumentation	increased penetration & sensitivity	major; new	incremental	UNB & DNR
Data handling	computing	information retrieval and analysis	moderate lower costs, faster	incremental peripheral; technology transfer	DNR digitization
Geochemistry	chemistry biology	increased information	moderate new & better deposits	incremental;	DNR & UNB
Remote sensing	data imagery	new concepts increased information	new and better deposits	major	UNB Geology & Survey Engineering Centre of expertise
Mine Design					
Mineral modelling	geology	improved information	reduced risk	incremental core	DNR

Activity	Science or Technology Involved	Anticipated Innovation	Industry Advantage	Kind of Technological Change	Lead Agency
Economic Modelling	mineral economics	improved information	reduced risk	incremental core	DNR
Methods Design	mineral engineering, basic methods and equipment	new methods for u.g. hardrock	major; cost reduction	major; core & pheri-pheral	DNR & UNB
		computing	software for design	cost reduction	pheripheral; technology transfer
Mining					
R&D: basic and applied	physics geology mining, biology	new methods instrumen-tation information	major; reduced costs improved recoveries improved H&S	major core & peripheral	DNR & UNB
Underground Mining					
Automations and control	mining, mechanical electrical engineering robotics	equipment and process automation	moderate; reduced costs increased recovery improved H&S	incremental core & peripheral; technology transfer	UNB & RPC
Rock mechanics	mining engineering geology, physics	prevention of rock bursts	moderate; improved H&S reduced risk	incremental core	DNR & UNB
Materials Handling	mechanical engineering	continuous methods & equipment	moderate; reduced costs	incremental; core technology transfer	UNB

Activity	Science or Technology Involved	Anticipated Innovation	Industry Advantage	Kind of Technological Change	Lead Agency
Processing					
Applied and Basic Research	Inter-disciplinary	new approaches to milling circuits and equipment	moderate; reduced costs	major; core and peripheral	DNR & RPC
Presorting	inter-disciplinary	application of existing techniques to sorting	moderate; improved recoveries	incremental; technology transfer	DNR & RPC
Automation and control	inter-disciplinary	complete automation of milling circuits	moderate; reduced costs	incremental technology transfer	C&T
Gold milling	mineral processing	new methods, new equipment	moderate reduced costs improved recovery, improved environment	major & incremental; core; Can. technology & technology transfer	DNR & RPC
Extractive Metallurgy					
Hydro-metallurgy	metallurgy, chemistry	improved separation	major; improved recoveries reduced costs	incremental; core	C&T, DNR & RPC
		reduction of effluents	moderate; improved environment	incremental peripheral	

Activity	Science or Technology Involved	Anticipated Innovation	Industry Advantage	Kind of Technological Change	Lead Agency
Biohydro-metallurgy	metallurgy, biology, chemistry	new methods of recovery	major; bypass milling and possibly part of mining stage; plus moderate improved recoveries from low-grade costs ores improved environment	major and incremental core and peripheral	C&T - RPC & DNR
Pyrometallurgy	metallurgy	continuous and closed methods	moderate; improved recovery, reduced cost improved environment	incremental; core technology transfer	RPC
Automation & control	inter-disciplinary	complete automation of processes	moderate; improved quality reduced costs	incrementa; core & peripheral technology transfer	UNB
Physical Metallurgy Properties and Products	Inter-disciplinary; metallurgy, physics, chemistry new materials	New product development and applications	major; new markets	major and incremental core and peripheral	C&T DNR & RPC
		Improved product quality	moderate, price premium market strength	incremental, core	
		New byproduct recoveries and applications	moderate; high value-added products	incremental core peripheral	